

CLAIMS

What is claimed is:

1. A projection system for use in image display apparatus, comprising a red channel projection lens, a green channel projection lens, and a blue channel projection lens, each of the projection lenses including a plurality of optical elements having at least one molded plastic element, wherein at least one element of said projection lens has a diffractive structure for correcting chromatic aberrations associated with the spectral band associated with said projection lens.
2. The projection system of Claim 1, wherein said diffractive structure is different for each projection lens, and disposed on the molded plastic element.
3. The projection system of Claim 2, wherein each of the red channel projection lens, the green channel projection lens and the blue channel projection lens includes same optical elements except for an optical element with said different diffractive structure.
4. The projection system of Claim 1, wherein one of the optical elements used in each of the red channel projection lens, the green channel projection lens, and the blue channel projection lens is an optical glass element with spherical surfaces, such that most of the refractive power of said projection lens is provided by the optical glass element, and the optical plastic elements all have very little refractive power to make themselves thin enough to be molded with adequate precision.
5. The projection system of Claim 4, wherein each of the red channel projection lens, the green channel projection lens and the blue channel projection lens includes same optical elements except for an optical element

with different diffractive structure.

6. The projection system of Claim 5, wherein said diffractive structure is different for each projection lens, and disposed on a molded plastic element.

7. The projection system of Claim 5, wherein said projection lens includes aspheric surfaces, the aspheric surfaces are defined by a polynomial that is comprised of the conic term, even-powered terms and odd-powered terms, which permit more rapid changes in local surface slope to improve aberration correction.

8. The projection system of Claim 2, wherein said diffractive structure is a true surface kinoform.

9. A projection system for use in image display apparatus, comprising a red channel projection lens, a green channel projection lens, and a blue channel projection lens, each of the projection lenses including five optical elements, wherein at least one element of said projection lens has a diffractive structure for correcting chromatic aberrations associated with the spectral band associated with said projection lens.

10. The projection system of Claim 9, wherein a first element facing to the projected image is a molded plastic element, a second element is a molded plastic element, a third element is a glass element with spherical surfaces, a fourth element is a molded plastic element, and a fifth element is a molded plastic element.

11. The projection system of Claim 10, wherein a diffractive structure is disposed on one of the molded plastic elements.

12. The projection system of Claim 11, wherein a diffractive structure is disposed on the rear surface of the second element, so that a diffractive surface is a fourth surface from the projected image.

13. The projection system of Claim 12, wherein each of the red channel

projection lens, the green channel projection lens, and the blue channel projection lens has same optical elements except for an optical element with different diffractive structure, such that the axial chromatic aberration of each spectral band is optimally corrected and maximum diffraction efficiency is achieved.

14. The projection system of Claim 13, wherein said projection lens includes aspheric surfaces, the aspheric surfaces are defined by a polynomial that is comprised of the conic term, even-powered terms and odd-powered terms, which permit more rapid changes in local surface slope to improve aberration correction.

15. The projection system of Claim 11, wherein said diffractive structure is a true surface kinoform.

16. A projection system for use in image display apparatus, comprising a red channel projection lens, a green channel projection lens, and a blue channel projection lens, each of the projection lenses including a plurality of optical elements, wherein at least said one element of said projection lens has a diffractive structure for correcting chromatic aberrations associated with the spectral band associated with said projection lens, so that the distance from object to image of the image display apparatus can be reduced or the relative aperture of the image display apparatus can be increased without undue loss of image resolution.

17. The projection system of Claim 16, wherein the projection lens includes five elements: a first element closest to the projected image comprised of a molded plastic material with aspheric surfaces, a second element comprised of a molded plastic material with aspheric surfaces, a third element comprised of optical glass with spherical surfaces, a fourth element comprised of a molded plastic material with aspheric surfaces, and a

fifth element comprised of a molded plastic material with aspheric surfaces , wherein a different diffractive structure is disposed on one of the molded plastic elements.

18. The projection system of Claim 17, wherein said different diffractive structure is disposed on the fourth surface apart from the projected image, such that the diffractive structure provides optimal chromatic aberration and optimal diffraction efficiency for the projection lens with a specific color channel.

19. The projection system of Claim 18, wherein the aspheric surfaces are defined by a polynomial that is comprised of the conic term, even-powered terms and odd-powered terms that permit more rapid changes in local surface slope and consequently improved aberration correction.